

ALTERNATIVE HEPA FILTER FOR HIGH LEVEL LIQUID WASTE STORAGE TANK VENT GAS

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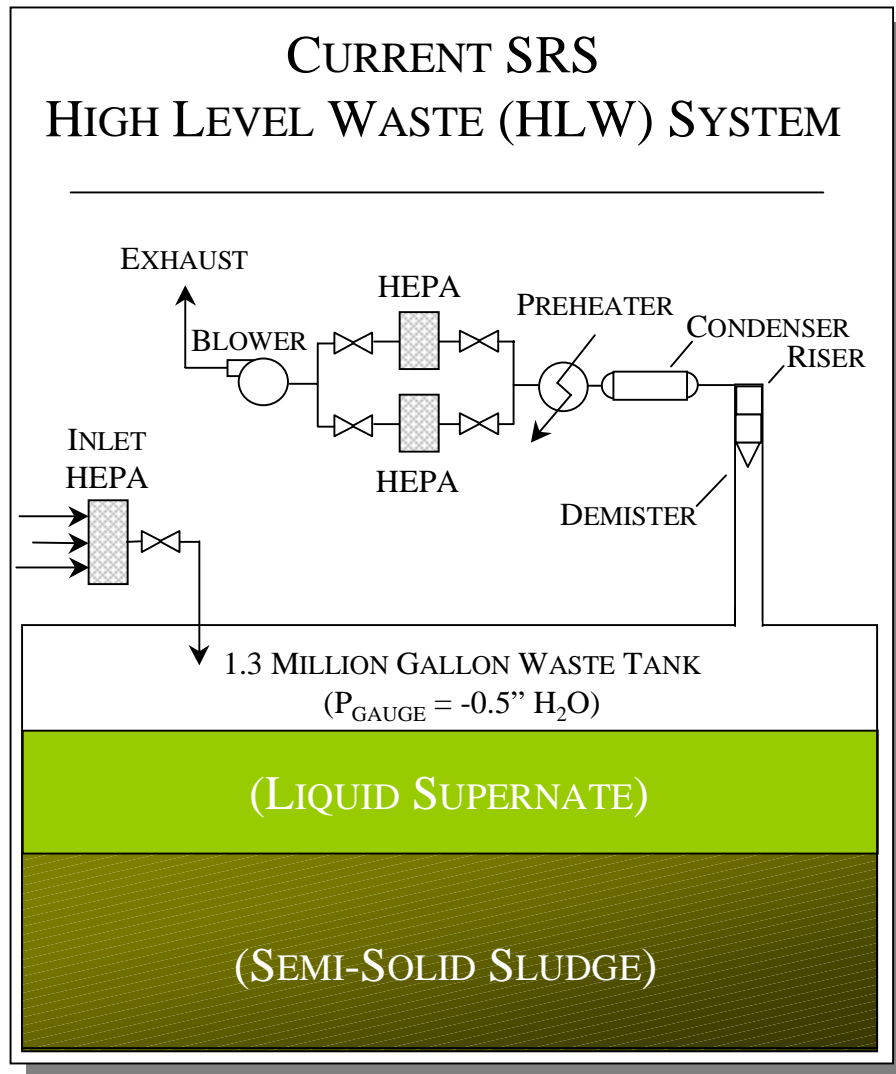
Westinghouse SRS

Industry Partnerships to Deploy Environmental Technology Conference

Federal Energy Technology Center

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INTRODUCTION & BACKGROUND



PROBLEMS

- High cost of periodic removal, replacement, and disposal of spent HEPA filters.
- Risk of potential exposure of personnel to radiation and contamination.

OBJECTIVES

Develop an alternative filter which ...

... can be regenerated *in-situ*:

- + Minimize waste
- + Minimize labor
- + Minimize the risk of personnel exposure
- + Minimize the filter cost

... is fully compatible with HLW tank contents:

- + No organics or chlorides
- + Filter exposure / durability regarding:
 - Long-term degradation from caustic & acidic media
 - Irreversible filter plugging
- + Prevent the passage of moisture (to minimize or eliminate the use of ventilation separation processes)

PHASE I APPROACH:

PROTOTYPE DEMONSTRATION & CONCEPTUAL DESIGN

TASK

Design, fabricate and deliver a prototype regenerable HEPA filter element (RHFE)

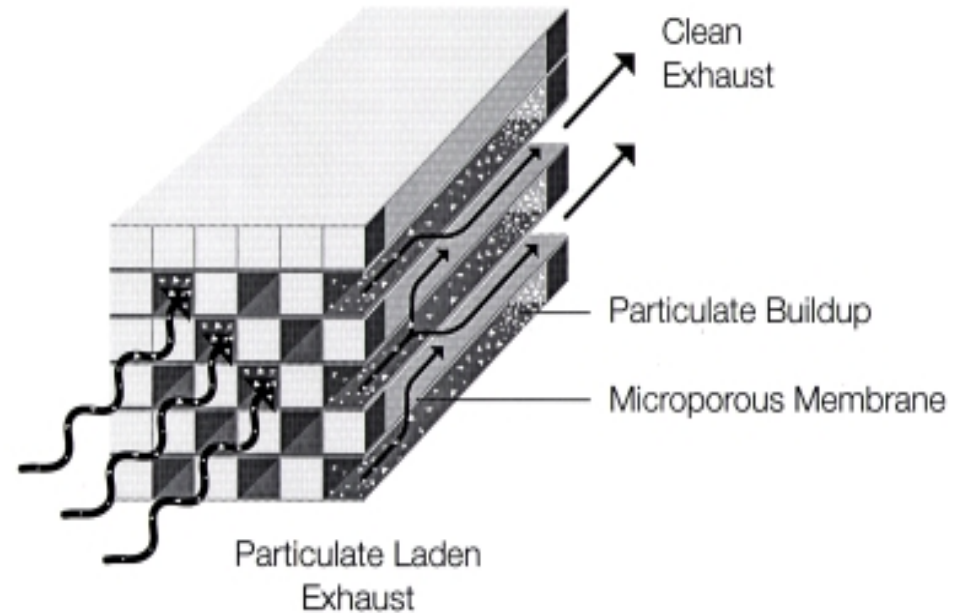
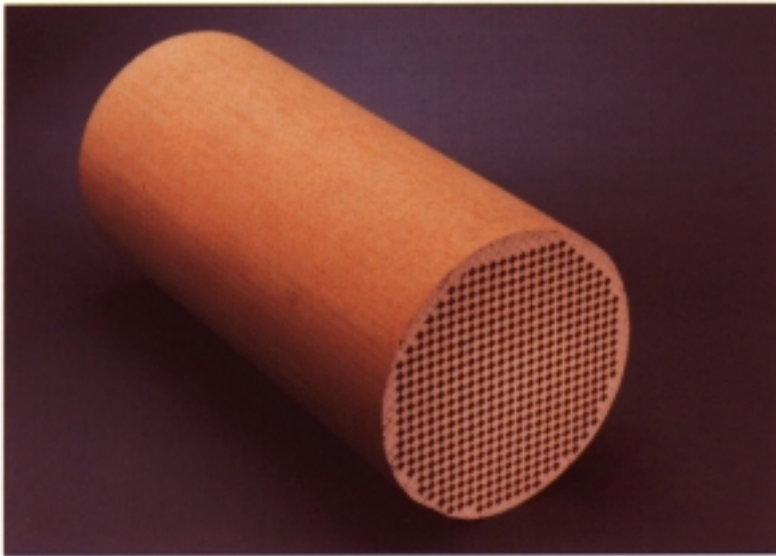
Conceptually design a full scale regenerable HEPA filter system

EVALUATION CRITERIA

- + Compliance w/ performance criteria
- + In-situ filter regenerability
 - Type/quantity of cleaning media
- + RHFE lifetime
- + Adaptability of design for pilot scale testing

Usability to develop a feasible Phase II technical plan

THE CERAMEM REGENERABLE HEPA FILTER ELEMENT



Full Size Filter Characteristics

Monolith Material: SiC or equivalent (Cordierite shown)

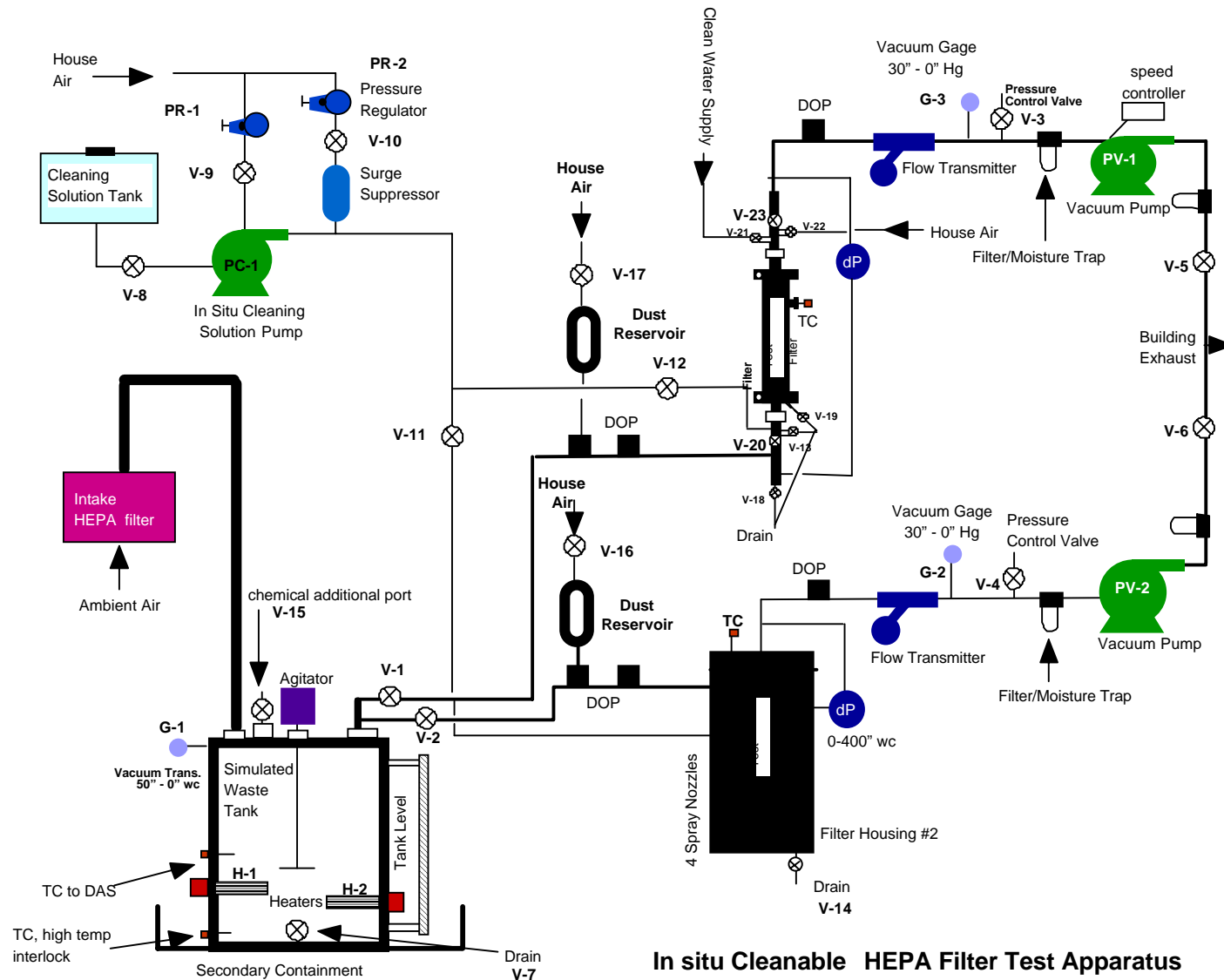
Cell Size: 0.2 cm (0.079 in.)

Diameter: 14.4 cm (5.66 in.)

Length: 30.5 cm (12 in.)

Internal Surface Area: 1.7 m² (18.5 ft²)

HEPA FILTER TESTING APPARATUS (HFTA)



ACCOMPLISHMENTS:

FILTER PERFORMANCE DEMONSTRATED AT SRTC

Test

Thermally generated Poly Alpha Olefin smoke particles
(0.3 μm particle diameter)

Filter

Particle Removal Efficiency

CERAMEM RHFE

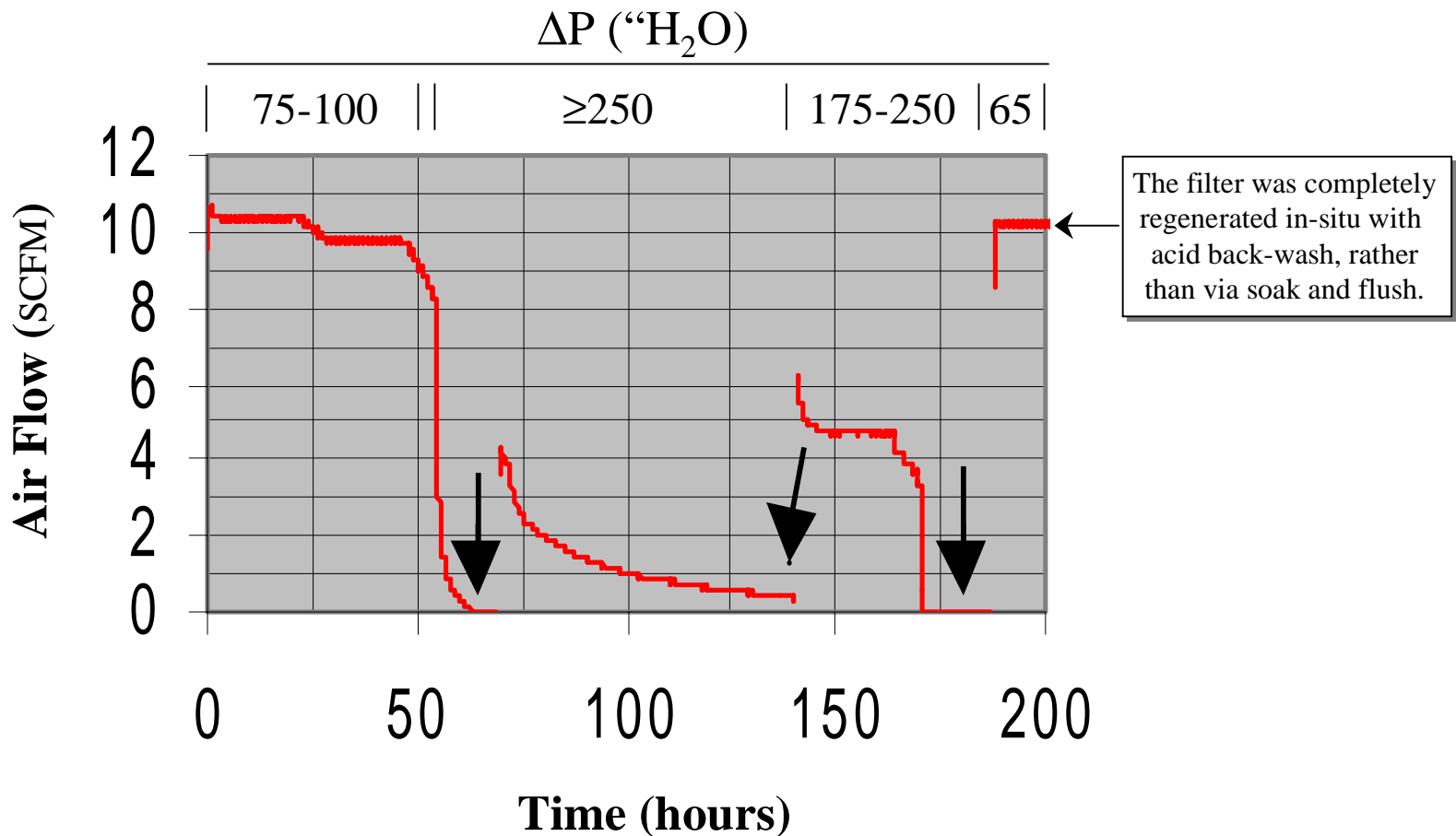
>99.99%

Glass-Fiber HEPA

99.97-99.99%

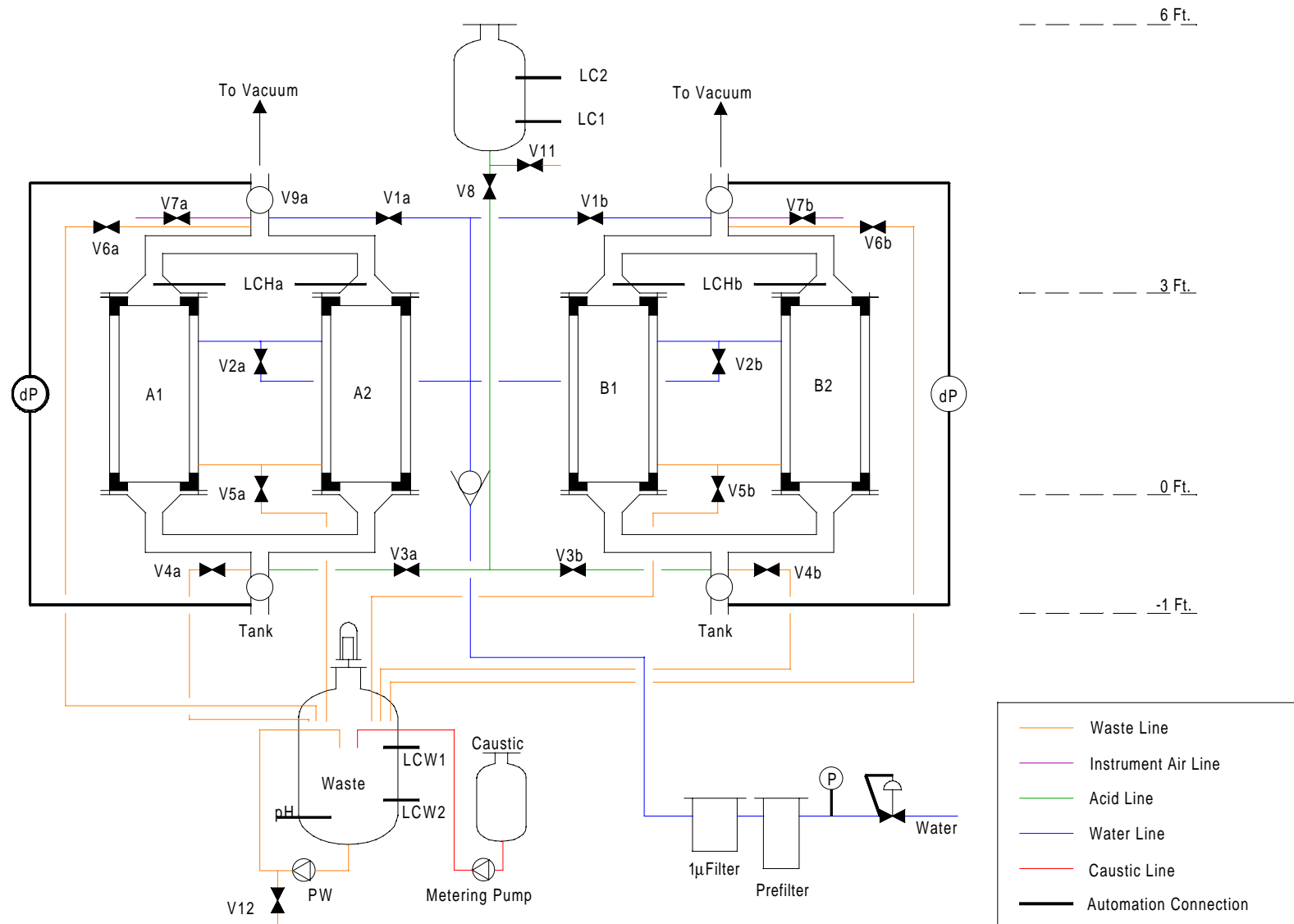
ACCOMPLISHMENTS:

FILTER PERFORMANCE DEMONSTRATED USING DUST



Testing was conducted with South Carolina Road Dust - a simulant for atmospheric dust which leaks into the HLW tank. The filter was cleaned in-situ (↓) with 10% HNO₃, and rinsed with clean H₂O.

CONCEPTUAL DESIGN OF FULL-SCALE RHFE SYSTEM



SUMMARY OF THE TECHNOLOGY & BENEFITS

- Designed, fabricated and delivered a prototype regenerable HEPA filter element (RHFE)
 - + Demonstrated >99.99% removal efficiency for 3 μm Poly Alpha Olefin particles
 - + Testing with South Carolina Road Dust demonstrated reasonable lifetime, ΔP , and ability to be regenerated *in-situ*.
 - + Additional preliminary testing at SRTC indicates that the filter performs well for both salt-filled and sludge-filled HLW tank environments (data not shown).

- A conceptual full-scale RHFE system was designed as a starting point for Phase II technology scale-up activities.

PLANNED PHASE II ACTIVITIES

- Design

- + Retain Fisher-Klosterman, Inc. as the system designer
- + Scale-up and construct the filter housing assembly
- + Will use two parallel trains of *four* (not two) filter elements

- Filter Element

- + Scale the monolith diameter from 1 in. to 5.66 in. (length = 12 in.)
- + Increase monolith pore size from 6 μm to 15 μm (to decrease ΔP)
- + Develop alternative membrane formulations
- + Demonstrate filter chemical durability in both acidic and caustic media
- + Replace epoxy channel plugging cement with an inorganic cement

- Testing

- + All full-scale RHFE testing to be conducted at SRTC to demonstrate performance at target levels

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